

**ADVANCED SUBSIDIARY GCE  
MATHEMATICS (MEI)**

**4752/01**

Concepts for Advanced Mathematics (C2)

**WEDNESDAY 9 JANUARY 2008**

Afternoon

Time: 1 hour 30 minutes

**Additional materials:** Answer Booklet (8 pages)  
MEI Examination Formulae and Tables (MF2)

**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the spaces provided on the answer booklet.
- Read each question carefully and make sure you know what you have to do before starting your answer.
- Answer **all** the questions.
- You are permitted to use a graphical calculator in this paper.
- Final answers should be given to a degree of accuracy appropriate to the context.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 72.
- You are advised that an answer may receive **no marks** unless you show sufficient detail of the working to indicate that a correct method is being used.

This document consists of **6** printed pages and **2** blank pages.

## Section A (36 marks)

1 Differentiate  $10x^4 + 12$ . [2]

2 A sequence begins

1 2 3 4 5 1 2 3 4 5 1 ...

and continues in this pattern.

(i) Find the 48th term of this sequence. [1]

(ii) Find the sum of the first 48 terms of this sequence. [2]

3 You are given that  $\tan \theta = \frac{1}{2}$  and the angle  $\theta$  is acute. Show, without using a calculator, that  $\cos^2 \theta = \frac{4}{5}$ . [3]

4

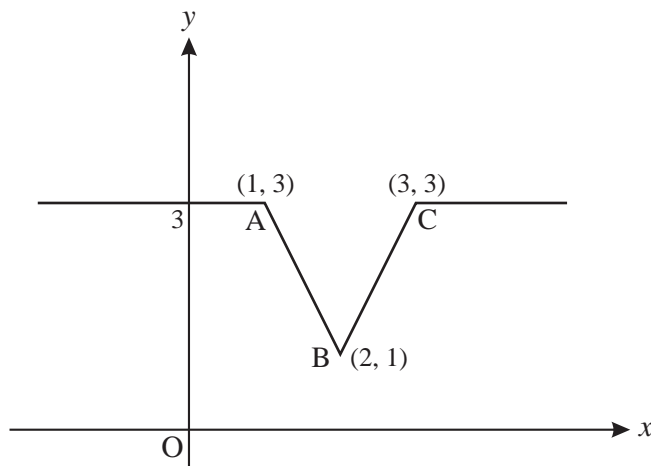


Fig. 4

Fig. 4 shows a sketch of the graph of  $y = f(x)$ . On separate diagrams, sketch the graphs of the following, showing clearly the coordinates of the points corresponding to A, B and C.

(i)  $y = 2f(x)$  [2]

(ii)  $y = f(x + 3)$  [2]

5 Find  $\int (12x^5 + \sqrt[3]{x} + 7) dx$ . [5]

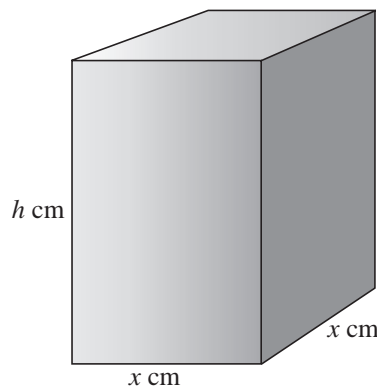
6 (i) Sketch the graph of  $y = \sin \theta$  for  $0 \leq \theta \leq 2\pi$ . [2]

(ii) Solve the equation  $2 \sin \theta = -1$  for  $0 \leq \theta \leq 2\pi$ . Give your answers in the form  $k\pi$ . [3]

- 7 (i) Find  $\sum_{k=2}^5 2^k$ . [2]
- (ii) Find the value of  $n$  for which  $2^n = \frac{1}{64}$ . [1]
- (iii) Sketch the curve with equation  $y = 2^x$ . [2]
- 8 The second term of a geometric progression is 18 and the fourth term is 2. The common ratio is positive. Find the sum to infinity of this progression. [5]
- 9 You are given that  $\log_{10} y = 3x + 2$ .
- (i) Find the value of  $x$  when  $y = 500$ , giving your answer correct to 2 decimal places. [1]
- (ii) Find the value of  $y$  when  $x = -1$ . [1]
- (iii) Express  $\log_{10}(y^4)$  in terms of  $x$ . [1]
- (iv) Find an expression for  $y$  in terms of  $x$ . [1]

**Section B (36 marks)**

10



**Fig. 10**

Fig. 10 shows a solid cuboid with square base of side  $x$  cm and height  $h$  cm. Its volume is  $120 \text{ cm}^3$ .

- (i) Find  $h$  in terms of  $x$ . Hence show that the surface area,  $A \text{ cm}^2$ , of the cuboid is given by  $A = 2x^2 + \frac{480}{x}$ . [3]
- (ii) Find  $\frac{dA}{dx}$  and  $\frac{d^2A}{dx^2}$ . [4]
- (iii) Hence find the value of  $x$  which gives the minimum surface area. Find also the value of the surface area in this case. [5]

- 11 (i) The course for a yacht race is a triangle, as shown in Fig. 11.1. The yachts start at A, then travel to B, then to C and finally back to A.

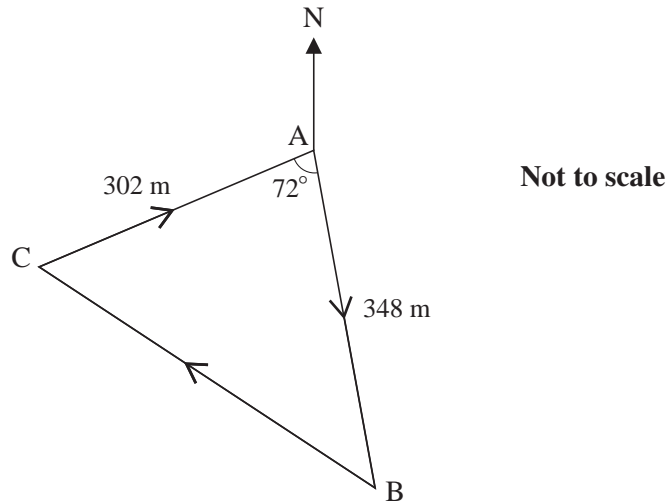


Fig. 11.1

- (A) Calculate the total length of the course for this race. [4]
- (B) Given that the bearing of the first stage, AB, is  $175^\circ$ , calculate the bearing of the second stage, BC. [4]
- (ii) Fig. 11.2 shows the course of another yacht race. The course follows the arc of a circle from P to Q, then a straight line back to P. The circle has radius 120 m and centre O; angle POQ =  $136^\circ$ .

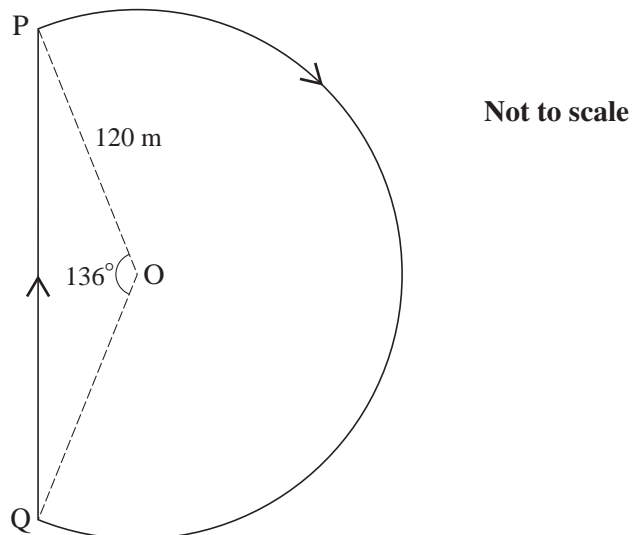


Fig. 11.2

Calculate the total length of the course for this race. [4]

12 (i)

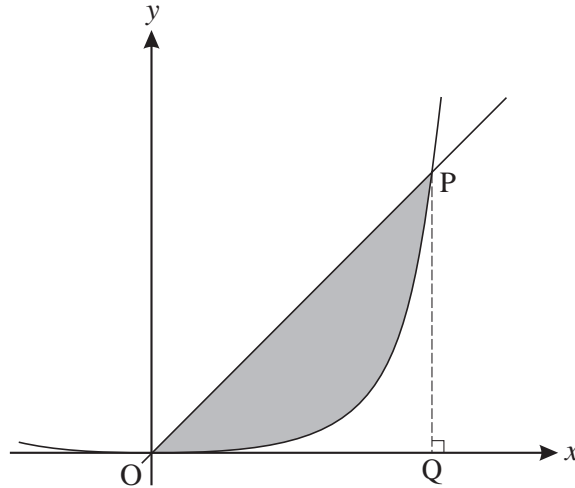


Fig. 12

Fig. 12 shows part of the curve  $y = x^4$  and the line  $y = 8x$ , which intersect at the origin and the point P.

(A) Find the coordinates of P, and show that the area of triangle OPQ is 16 square units. [3]

(B) Find the area of the region bounded by the line and the curve. [3]

(ii) You are given that  $f(x) = x^4$ .

(A) Complete this identity for  $f(x+h)$ .

$$f(x+h) = (x+h)^4 = x^4 + 4x^3h + \dots \quad [2]$$

(B) Simplify  $\frac{f(x+h) - f(x)}{h}$ . [2]

(C) Find  $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ . [1]

(D) State what this limit represents. [1]